

## Solving Exponential and Logarithmic Equations

Date \_\_\_\_\_

**CLASS EXAMPLES - EXPONENTIAL EQUATIONS: Solve each equation.**

1)  $5^{3a} = 5^{2a+2}$

2)  $32^{2x} = 2^4$

**EXPONENTIAL EQUATIONS: Solve each equation.**

3)  $625^{x+1} = 25^x$

4)  $36^{3m} = 216^{-m}$

5)  $3^{-3n-2} = 3^{3n-1}$

6)  $64^{3x} = 16$

**CLASS EXAMPLES: Solve each equation. Round your answers to the nearest ten-thousandth.**

7)  $10^a + 10 = 46$

8)  $e^a = 26$

9)  $10^{7x} = 12$

10)  $e^{n-2} - 5 = 61$

**Solve each equation. Round your answers to the nearest ten-thousandth.**

11)  $4^x = 72$

12)  $e^{b-2} = 12$

13)  $e^r - 7 = 57$

14)  $13^{-10r} + 2 = 48$

**CLASS EXAMPLES: Solve each equation. (LOGS ON BOTH SIDES)**

15)  $\log_4 (b^2 + 11) = \log_4 (-10b + 2)$

16)  $\ln (x + 4) + \ln 3 = \ln 63$

17)  $\log_6 9 - \log_6 (x - 2) = \log_6 49$

18)  $\log (x^2 + 9) + \log 2 = \log 36$

**Solve each equation.**

19)  $\ln (2k + 7) = \ln (-k - 8)$

20)  $\ln -5v = \ln (3v + 3)$

21)  $\log_{20} (n^2 + 6n) = \log_{20} (-20 - 3n)$

22)  $\log_4 -3x - \log_4 2 = \log_4 43$

$$23) \log_4 3x^2 - \log_4 6 = 3$$

$$24) \ln x - \ln(x - 2) = \ln 28$$

**CLASS EXAMPLES: Solve each equation. (LOGS ON ONE SIDE)**

$$25) \log_4 n = 0$$

$$26) \ln(p + 2) = 3$$

$$27) 1 + \log_8 5r = 5$$

$$28) \log_2 9 + \log_2 4x^2 = 4$$

**Solve each equation.**

$$29) \log_8 n = 2$$

$$30) \log_9(n + 7) = 4$$

$$31) \log_2 9r = 3$$

$$32) 2\log_8 x = -2$$

$$33) 10\log_5 x = 0$$

$$34) 2\log 10n = 6$$

$$35) \log_3(x + 6) - \log_3 x = 5$$

$$36) \log_7 2x + \log_7 8 = 1$$

37)  $\log_5 (x^2 - 10) + \log_5 9 = 1$

38)  $\log_7 4x^2 + \log_7 4 = 4$

39) Sophie is buying a used car for \$4,500.00. The car is depreciating at a rate of 5% each month.

- a) Write an equation which models the value of the car after "x" months.
- b) How much will the car be worth after 8 months?
- c) When will the car's value be \$2,000?

40) William has a goat farm with 6 goats. It is predicted that the goat population will grow at a rate of 20% each year.

- a) Write an equation which will model the number of goats he has after "x" years.
- b) How many goats will William have after 10 years?
- c) How long will it take William to end up with a herd of 20 goats?

41) Mr. Allen-Black deposited \$3,200 into a savings account, which pays him 3.5% APR.

- a) How much will Mr. Allen-Black have accrued in the account after 5 years if the interest is compounded quarterly?
- b) How much less (or more?) would Mr. Allen-Black have accrued in 5 years if the interest were compounded continuously?
- c) How many years would it take Mr. A-B to accrue \$10,000 considering the interest is compounded quarterly?
- d) How many years would it take Mr. A-B to accrue \$10,000 if the interest was compounded continuously?

## Solving Exponential and Logarithmic Equations

Date \_\_\_\_\_

**CLASS EXAMPLES - EXPONENTIAL EQUATIONS: Solve each equation.**

1)  $5^{3a} = 5^{2a+2}$

 $\{2\}$ 

2)  $32^{2x} = 2^4$

 $\left\{\frac{2}{5}\right\}$ **EXPONENTIAL EQUATIONS: Solve each equation.**

3)  $625^{x+1} = 25^x$

 $\{-2\}$ 

4)  $36^{3m} = 216^{-m}$

 $\{0\}$ 

5)  $3^{-3n-2} = 3^{3n-1}$

 $\left\{-\frac{1}{6}\right\}$ 

6)  $64^{3x} = 16$

 $\left\{\frac{2}{9}\right\}$ **CLASS EXAMPLES: Solve each equation. Round your answers to the nearest ten-thousandth.**

7)  $10^a + 10 = 46$

1.5563

8)  $e^a = 26$

3.2581

9)  $10^{7x} = 12$

0.1542

10)  $e^{n-2} - 5 = 61$

6.1897

**Solve each equation. Round your answers to the nearest ten-thousandth.**

11)  $4^x = 72$

3.085

12)  $e^{b-2} = 12$

4.4849

13)  $e^r - 7 = 57$

4.1589

14)  $13^{-10r} + 2 = 48$

-0.1493

**CLASS EXAMPLES: Solve each equation. (LOGS ON BOTH SIDES)**

15)  $\log_4 (b^2 + 11) = \log_4 (-10b + 2)$

$\{-9, -1\}$

16)  $\ln (x + 4) + \ln 3 = \ln 63$

$\{17\}$

17)  $\log_6 9 - \log_6 (x - 2) = \log_6 49$

$\left\{ \frac{107}{49} \right\}$

18)  $\log (x^2 + 9) + \log 2 = \log 36$

$\{3, -3\}$

**Solve each equation.**

19)  $\ln (2k + 7) = \ln (-k - 8)$

No solution.

20)  $\ln -5v = \ln (3v + 3)$

$\left\{ -\frac{3}{8} \right\}$

21)  $\log_{20} (n^2 + 6n) = \log_{20} (-20 - 3n)$

No solution.

22)  $\log_4 -3x - \log_4 2 = \log_4 43$

$\left\{ -\frac{86}{3} \right\}$

23)  $\log_4 3x^2 - \log_4 6 = 3$

$$\{8\sqrt{2}, -8\sqrt{2}\}$$

24)  $\ln x - \ln(x - 2) = \ln 28$

$$\left\{\frac{56}{27}\right\}$$

**CLASS EXAMPLES: Solve each equation. (LOGS ON ONE SIDE)**

25)  $\log_4 n = 0$

$$\{1\}$$

26)  $\ln(p + 2) = 3$

$$\{e^3 - 2\}$$

27)  $1 + \log_8 5r = 5$

$$\left\{\frac{4096}{5}\right\}$$

28)  $\log_2 9 + \log_2 4x^2 = 4$

$$\left\{\frac{2}{3}, -\frac{2}{3}\right\}$$

**Solve each equation.**

29)  $\log_8 n = 2$

$$\{64\}$$

30)  $\log_9(n + 7) = 4$

$$\{6554\}$$

31)  $\log_2 9r = 3$

$$\left\{\frac{8}{9}\right\}$$

32)  $2\log_8 x = -2$

$$\left\{\frac{1}{8}\right\}$$

33)  $10\log_5 x = 0$

$$\{1\}$$

34)  $2\log 10n = 6$

$$\{100\}$$

35)  $\log_3(x + 6) - \log_3 x = 5$

$$\left\{\frac{3}{121}\right\}$$

36)  $\log_7 2x + \log_7 8 = 1$

$$\left\{\frac{7}{16}\right\}$$

$$37) \log_5 (x^2 - 10) + \log_5 9 = 1$$

$$\left\{ \frac{\sqrt{95}}{3}, -\frac{\sqrt{95}}{3} \right\}$$

$$38) \log_7 4x^2 + \log_7 4 = 4$$

$$\left\{ \frac{49}{4}, -\frac{49}{4} \right\}$$

39) Sophie is buying a used car for \$4,500.00. The car is depreciating at a rate of 5% each month.

- Write an equation which models the value of the car after "x" months.
- How much will the car be worth after 8 months?
- When will the car's value be \$2,000?

a)  $y = 4500 \cdot 0.95^x$    b) \$2,985.39   c) 15.81 months

40) William has a goat farm with 6 goats. It is predicted that the goat population will grow at a rate of 20% each year.

- Write an equation which will model the number of goats he has after "x" years.
- How many goats will William have after 10 years?
- How long will it take William to end up with a herd of 20 goats?

a)  $y = 6 \cdot 1.2^x$    b) 37.15 goats   c) 6.604 Years

41) Mr. Allen-Black deposited \$3,200 into a savings account, which pays him 3.5% APR.

- How much will Mr. Allen-Black have accrued in the account after 5 years if the interest is compounded quarterly?
- How much less (or more?) would Mr. Allen-Black have accrued in 5 years if the interest were compounded continuously?
- How many years would it take Mr. A-B to accrue \$10,000 considering the interest is compounded quarterly?
- How many years would it take Mr. A-B to accrue \$10,000 if the interest was compounded continuously?

a) \$3809.09   b) \$2.90 more   c) 32.70 yrs.   d) 32.56 yrs.